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A YANG Data Model for Power over Ethernet System management
draft-zhuang-netmod-yang-poe-management-02

Abstract

This memo defines a YANG data model for Power over Ethernet System for use with network management protocols. This document augments the IEEE 802.3 PSE module with attributes to manage PSE port and provide notification of powering states. Besides, it also provides power source management for the whole system.

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[1.](#) Introduction

This document defines a YANG [[RFC7950](#)] data model for the management of power over Ethernet [IEEE 802.3at] Power Sourcing Equipment (PSE).

[2.](#) Definitions an Acronyms

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [[RFC2119](#)].

[2.1.](#) Terminology

The following abbreviations are defined in [[IEEE-802.3at](#)] and will be used with the same significance in this document:

PSE - Power Sourcing Equipment;

PD - Powered Device

[2.2.](#) Tree diagram

The following notations are used within the data tree and carry the meaning as below.

Each node is printed as:

<status> <flags> <name> <opts> <type>

<status> is one of:

- + for current
- x for deprecated
- o for obsolete

<flags> is one of:

- rw for configuration data
- ro for non-configuration data
- x for rpcs
- n for notifications

<name> is the name of the node

If the node is augmented into the tree from another module, its name is printed as <prefix>:<name>.

<opts> is one of:

- ? for an optional leaf or choice
- ! for a presence container
- * for a leaf-list or list
- [<keys>] for a list's keys

<type> is the name of the type for leafs and leaf-lists

In this document, these words will appear with that interpretation only when in ALL CAPS. Lower case uses of these words are not to be interpreted as carrying [RFC-2119](#) significance.

[3.](#) Overview

Power over Ethernet (PoE) provides a way to allows devices receiving power over the same cable used for data transmission. It also enables applications of powered devices connected to the network and managed by a remote management application. The IEEE 802.3 Working Group has finished two standardization projects on this subject, known as IEEE 802.3af and IEEE 802.3at.

With the increase of required power level in nowadays, the Working Group is now working on the 4-pair PoE which provides up to 90 watts powering known as IEEE 802.3bt [IEEE 802.3bt] to enable more applications such as lighting over Ethernet for intelligent lighting system.

The IEEE 802.3 WG is currently also working on a YANG data model for the management of Power Source Equipment in [IEEE P802.3.2], however, it did not define a full management interface, but only the managed objects based on the hardware registers. The module defined in this document is an extension to that module to provide management required for the poe system and ports as defined in Power Ethernet

MIB[RFC3621], so as to be used by the system administrator for management.

[4.](#) Design of the data model

This document defines the YANG module "ietf-poe-power-management", which has two parts: main power source management and pse port management. Besides, the module also defines several notifications for the port and power source. The model structure is as follows:

```
module: ietf-poe-power-management
  +--rw main-power-source-config
  |   +--rw main-power-source-entry* [slot-id]
  |       +--rw slot-id                uint32
  |       +--rw usage-threshold?      percentage
  +--ro main-power-sources-state
  |   +--ro main-power-source-entry* [slot-id]
  |       +--ro slot-id                uint32
  |       +--ro power-info
  |           +--ro total-power?        decimal64
  |           +--ro reserved-power?     percentage
  |           +--ro consuming-power?    decimal64
  |           +--ro remained-power?     decimal64
  |           +--ro peak-power?         decimal64
  |           +--ro usage-threshold?    percentage
  |       +--ro operStatus?            enumeration
  augment /if:interfaces/if:interface/eth:ethernet/pse:poe-pse:
  |   +--rw event-notification-enable?  boolean
  augment /if:interfaces/if:interface/eth:ethernet/pse:poe-pse/pse:multi-pair:
  |   +--rw poe-ports-config
  |       +--rw power-priority?         uint32
  |       +--rw connected-pd-type?      string
```

notifications:

```
+---n poe-port-notification
|   +--ro event* [if-name event-type]
|       +--ro if-name          string
|       +--ro event-type       identityref
|       +--ro event-content
|           +--ro detection-status?    pse-detection-state
|           +--ro pd-connection-events identityref
+---n poe-power-notification
    +--ro event* [slot-id event-type]
        +--ro slot-id          uint8
        +--ro event-type       identityref
        +--ro event-content
            +--ro power-usage
                +--ro consuming-power    uint32
                +--ro usage-threshold?   uint32
```

[4.1.](#) Main Power Source management

As defined Power Ethernet MIB[RFC3621], the main power source container defines the management attributes for a managed main power source in a PSE device. Ethernet switches are one example of boxes that would support these objects.

```
module: poe-power-management
+--rw main-power-source-config
|   +--rw main-power-source-entry* [slot-id]
|       +--rw slot-id          uint32
|       +--rw usage-threshold? percentage
+--ro main-power-sources-state
    +--ro main-power-source-entry* [slot-id]
        +--ro slot-id          uint32
        +--ro power-info
            +--ro total-power?    decimal64
            +--ro reserved-power? percentage
            +--ro consuming-power? decimal64
            +--ro remained-power? decimal64
            +--ro peak-power?     decimal64
            +--ro usage-threshold? percentage
```

+++ro operStatus? enumeration

Container "poe-power-management" contains a list of main power source entry in both configuration and operational state. In configuration, the entry contains a slot-id node to indicate its belonged chassis id. It also provides a usage-threshold to express in percents for comparing the measured power and initiating an alarm if the threshold is exceeded.

For the operational state, the main power source entry provides power information for the management, including the total power, reserved power, consuming power, remained power, peak power etc al. It also provide "operStauts" node to indicate current operational status of the main PSE whether it is on/off/faulty.

[4.2.](#) PSE port management

The pse port management augments the YANG module "ieee802-pse.yang" with extra management objects defined in Power Ethernet MIB [[RFC3621](#)] for required management of the pse ports.

```
        augment /if:interfaces/if:interface/eth:ethernet/pse:poe-pse:
+++rw event-notification-enable?    boolean
        augment /if:interfaces/if:interface/eth:ethernet/pse:poe-pse/ps
+++rw poe-ports-config
    +++rw power-priority?            uint32
    +++rw connected-pd-type?        String
```

Under the poe-pse container in ieee802-pse module, this document defines a data node to control the notification of event. Besides, for the multiple pair PSE, it defines power priority as pethPsePortPowerPrority object defined in PoE MIB to control the

priority of the port from the point of view of a power management system. The node "connected-pd-type" is the same as the pethPsePortType object in PoE MIB for a managr to indicate the type of the powered device that is connected to the port.

[4.3.](#) Notification

Consist with notifications defined in Power Etherent MIB [[RFC3621](#)],

this document also provides notifications for pse ports and power source to be transmitted from the agent to a management application.

```
        notifications:
+---n poe-port-notification
|   +--ro event* [if-name event-type]
|       +--ro if-name          string
|       +--ro event-type       identityref
|       +--ro event-content
|           +--ro detection-status?      pse-detection-state
|           +--ro pd-connection-events  identityref
+---n poe-power-notification
    +--ro event* [slot-id event-type]
        +--ro slot-id          uint8
        +--ro event-type       identityref
        +--ro event-content
            +--ro power-usage
                +--ro consuming-power    uint32
                +--ro usage-threshold?   uint32
```

This module defines two sets of notification for pse port and the power supply.

[5.](#) POE Power Management module

```
<CODE BEGINS> file "ietf-poe-power-management@2017-03-07.yang"
module ietf-poe-power-management{
    namespace "urn:ietf:params:xml:ns:yang:ietf-poe-power-management";
    prefix poe-power;

    import ietf-interfaces {
        prefix if;
    }
    import ieee802-ethernet-interface {
        prefix eth;
    }
    import ieee802-pse {
        prefix pse;
    }
}
```


organization
"IETF NETMOD (NETCONF Data Modeling Language) Working Group";

contact

"WG Web: < <http://tools.ietf.org/wg/netmod/> >
WG List: <<mailto:netmod@ietf.org>>
WG Chair: Lou Berger
<<mailto:lberger@labn.net>>
WG Chair: Kent Watsen
<<mailto:kwatsen@juniper.net>>

Editor: Yan Zhuang
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";

description

"This module contains YANG definitions for configuring and managing power system for Power Over Ethernet feature defined by IEEE 802.3. It provides functionality roughly equivalent to that of the POWER-ETHERNET-MIB defined in [RFC3621](#).";

revision 2017-03-09{

description

"Initial version of power management for IEEE 802.3 PSE.";

reference

"[draft-zhuang-netmod-yang-poe-management-00.txt](#)";

}

/*Identities and typedef*/

typedef percentage {

type uint8 {

range "0..100";

}

description "Percentage value in integer format.";

}

identity poe-port-event {

description "Poe port event notification base type.";

}

identity poe-power-module-event {

description "Poe power module event notification base type.";

}

identity power-usage-alarm {

```
        base poe-power-module-event ;
        description
        "Base identity for power usage event";
    }
    identity power-status-event {
        base poe-port-event ;
        description "Poe port power status change notification.";
    }

    identity pd-connection-status-event {
        base poe-port-event ;
        description "Poe port peer,the power device status change notification.
    }

    identity power-absence-event {
        base poe-port-event ;
        description "Poe port power absence notification.";
    }
    identity pd-connection-status {
        description
        "Base identity for the PD connnection status";
    }
    identity pd-connected {
        base pd-connection-status;
        description
        "pd is connected";
    }

    identity pd-disconnected {
        base pd-connection-status;
        description
        "pd is disconnected";
    }

    identity pd-class-invalid {
        base pd-connection-status;
        description "pd class is invalid";
    }

    identity pd-class-over-current {
        base pd-connection-status;
        description "pd class is over current";
    }

    typedef pse-detection-state {
        type enumeration {
```

```
enum disabled {  
    value 1;
```

```
        description "PSE disabled";  
    }  
    enum searching {  
        value 2;  
        description "PSE is searching";  
    }  
    enum deliveringPower {  
        value 3;  
        description "PSE is delivering power";  
    }  
    enum fault {  
        value 4;  
        description "PSE fault detected";  
    }  
    enum test {  
        value 5;  
        description "PSE test mode";  
    }  
    enum otherFault {  
        value 6;  
        description "PSE implementation specific fault detected";  
    }  
}  
    description  
    "detection state of a multi-pair PSE";  
    reference  
    "IEEE Std 802.3, 30.9.1.1.5";  
}  
  
/***** PSE port management *****/  
augment "/if:interfaces/if:interface/eth:ethernet/pse:poe-pse"{  
    description "enable pse port notification";  
    leaf event-notification-enable {  
        type boolean ;  
        default false ;  
        description "PSE port event notification switch.";  
    }  
}
```

```

augment "/if:interfaces/if:interface/eth:ethernet/pse:poe-pse/pse:multi-pair"
description "configuration of pse port management";
    container poe-ports-config {
        description "configuration for all poe ports.";
        leaf power-priority {
            type uint32;
            description
                "This object controls the priority of the port from the point
                of view of a power management algorithm.";
        }
    }

```

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```

    }
    leaf connected-pd-type {
        type string;
        description
            "A manager will set the value of this variable to indicate
            the type of powered device that is connected to the port.
            The default value supplied by the agent if no value has
            ever been set should be a zero-length octet string";
    }
}

augment "/if:interfaces-state/if:interface/eth:ethernet/pse:poe-pse/pse:multi-pair"
description "operational state for pse port";
container poe-ports-state {
    config false;
    description "operational state for all poe ports.";

    leaf power-priority {
        type uint32;
        description
            "This object controls the priority of the port from the point
            of view of a power management algorithm.";
    }

    leaf connected-pd-type {
        type string;
        description
            "A manager will set the value of this variable to indicate
            the type of powered device that is connected to the port.
            The default value supplied by the agent if no value has
            ever been set should be a zero-length octet string";
    }
}

```

```
}
```

```
/****** power source management *****/
/* Poe power module usage alarm configuration */
container main-power-source-config {

    list main-power-source-entry{
        key "slot-id";
        description "main power source entry";

        leaf slot-id {
            type uint32;
            description "Poe power module installed slot.";
        }
        leaf usage-threshold {
```

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```
        type percentage ;
        description
            "The usage threshold expressed in percents for
            comparing the measured power and initiating an alarm
            if the threshold is exceeded.";
    }
}
description "Configurations of the main power source.";
}

/*main source operational state*/
container main-power-sources-state {
    config false;

    description
        "operational state for main power source";

    list main-power-source-entry {
        key "slot-id";
        description "main power source entry";

        leaf slot-id {
            type uint32;
            description "Poe power module installed slot.";
```

```

}

container power-info {
  description
    "power information of the main power source";

  leaf total-power {
    type decimal64 {
      fraction-digits 4;
    }
    units 'watt';
    description
      "The nominal power of the PSE expressed in Watts";
  }

  leaf reserved-power {
    type percentage ;
    description
      "The percent of power that the system reserved.";
  }

  leaf consuming-power {
    type decimal64 {

```

```

    fraction-digits 4;
  }
  units 'watt';
  description
    "Measured usage power";
}

leaf remained-power {
  type decimal64 {
    fraction-digits 4 ;
  }
  units 'watt';
  description
    "total power * (1-reserved power)-consuming Power";
}

leaf peak-power {
  type decimal64 {

```

```

        fraction-digits 4;
    }
    units 'watt';
    description
        "the peak power";
}

leaf usage-threshold {
    type percentage ;

    description
        "The usage threshold expressed in percents for
        comparing the measured power and initiating
        an alarm if the threshold is exceeded.";
}
}

```

```

leaf operStatus {
    type enumeration {
        enum on {
            value 1;
            description "the main pse is on";
        }
        enum off {
            value 2;
            description "the main pse is off";
        }
        enum faulty {

```

```

        value 3;
        description "the main pse is faulty";
    }
}

default on;
description
    "The operational status of the main PSE";
}
}
}

```

```

/*
* Notifications
*/

/*
* Notifications
*/
notification poe-port-notification {
    description "Port event notification when the notification switch is on.";

    list event {
        key "if-name event-type";
        description "list of events";
        leaf if-name {
            type string ;
            description "Poe port interface name";
        }

        leaf event-type {
            type identityref {
                base poe-port-event ;
            }
            description "event type for poe port.";
        }
    }

    container event-content {
        description "Event notification content.";

        leaf detection-status {
            when " ../../event-type = 'pse:power-status-event' " ;
            type pse-detection-state;
            description "pse detection status";
        }

        leaf pd-connection-events {

```

```

when " ../../event-type = 'pse:pd-connection-status-event' " ;

type identityref {
    base pd-connection-status;

```



```

    }
        mandatory true;
        description "pd connection events";
    }
}
}
}
}
notification poe-power-notification {
    description "power event notification when the notification switch is on.";

    list event {
        key "slot-id event-type";
        description "list of power events.";
        leaf slot-id {
            type uint8 ;
            description "Slot id of the power source";
        }

        leaf event-type {
            type identityref {
                base poe-power-module-event ;
            }
            description "event type for main power source.";
        }
    }

    container event-content {
        description "Event notification content.";

        container power-usage {
            when " ../../event-type = 'poe-power:power-usage-alarm' " ;
            description "poe usage event content.";

            leaf consuming-power {
                type uint32;
                mandatory true;
                description "consuming power";
            }

            leaf usage-threshold {
                type uint32;
                description "usage threshold";
            }
        }
    }
}

```

```
    }  
  }  
}  
  <CODE ENDS>
```

[6.](#) Security Consideration

TBD

[7.](#) Acknowledgements

[8.](#) Normative References

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[Appendix A.](#) Related modules

Related moduels can be found at
<https://github.com/YangModels/yang/tree/master/standard/ieee/802.3/draft>.

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